PUBLIC DOCUMENT. No. 30

FIFTH ANNUAL REPORT

—OF THE—

NORTH DAKOTA AGRICULTURAL

EXPERIMENT STATION

FARGO, N. D.

—TO THE—

GOVERNOR.

FEBRUARY 1, 1895.

JAMESTOWN, N. D.
ALERT, STATE PRINTERS AND BINDERS.
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LETTER OF TRANSMITTAL

To His Excellency, Roger Allin, Governor of North Dakota:

SIR:—In compliance with the requirements of the Act of Congress approved March 2nd, 1887, and those of Section 13, Chapter 160 of the Laws of 1890 for North Dakota, I hereby submit the Fifth Annual Report of the North Dakota Agricultural Experiment Station for the year ending February 1st, 1895, together with a financial statement of receipts and disbursements, as required by law, for the government fiscal year ending June 30th, 1894.

Very respectfully yours,

H. F. MILLER,

President of Board of Trustees.

Fargo, N. D., February 1st, 1895.

STATION STAFF.

J. B. Power.....Director
E. F. Ladd, B. S.....Chemist
T. D. Hinebauch, M. S., V. S.....Veterinarian
C. B. Waldron, B. S.....Arboriculturist
H. L. Bolley, M. S.....Botanist
J. H. Shepperd, M. S. A.....Agriculturist
E. E. Kauffman, B. Ag.....Assistant in Agriculture
Wm. G. Hiatt.....Farm Foreman
Wm. G. Hayden.....Secretary

REPORT.

To the Board of Trustees North Dakota Agricultural College and Experimental Station:

GENTLEMEN:—Herewith find the Fifth Annual Report of the Agricultural Experiment Station, summarizing the results of the past year's work. The plans formulated and lines of experiments determined upon at the commencement of the work of the Station have been carefully and closely followed, where found to promise results that will be of practical value to the farmers of our State. The detail of all work in the various lines of investigation is under the immediate charge of the heads of the different departments, and a short resume of reports from each department is herein given.

CHEMICAL DEPARTMENT.

As in previous years the work in the chemical department has been a continuation of soil investigation, and it is proposed to enlarge this field of work as rapidly as the means will permit, until a thorough examination is made of all the soils of the State. Already much valuable data have been collected bearing on soil depletion from wheat growing and bare summer fallowing. During the coming summer it is proposed to make some special investigation along this line.

A large number of waters have been analyzed, and this line of work must continue to demand considerable time, owing to the fact that the waters of our State are so frequently alkaline.

A large number of food products have been analyzed, and Bulletin 15, recently published, gives results of analyses for several of these foods, and points out the loss that comes to our farmers from a failure to utilize many waste products that are valuable foods.

As in the past the work in meteorology has been continued by this department, and monthly reports made to the State weather

Bureau and to the Department of Agriculture at Washington. Below are given the per cents. of moisture in the soil each month for the past three years:

MONTH.	Surface soil (1 to 3 in.)			Subsoil (5 to 7 inches).		
	1892	1893	1894	1892	1893	1894
May	35.08	31.48	29.15	35.51	30.21	26.98
June	29.08	29.63	16.73	30.22	23.79	19.84
July	28.39	28.63	16.09	27.19	26.97	18.58
August	30.03	21.46	16.42	30.53	21.57	16.52
September	28.29	18.88	11.11	27.94	19.71	11.89
October	16.53	24.59	28.30	22.29	24.02	24.78

From the foregoing table it will be observed that the per cent. of water in the cultivated soil was much less in 1894 than in the two previous years, nevertheless a fair crop was produced with a small rainfall during the last of the growing season, when it seemed that failure must result. This would seem to be due to the fact that the water table for 1894 was only four to eight feet below the surface, and therefore supplied enough water to permit the growing crop to mature, by providing moisture for the roots of the plant extending down into the soil, while surface growers perished.

It would be a matter of interest and possibly of value to have a record of the movements of the water table in the ground for several growing seasons, as by this means data might be had that would prove of value in foretelling the probability of soil drought.

The following tables give the maxima, minima, and mean temperatures and the rainfall for the past three years:

TEMPERATURE—FAHRENHEIT.

MONTH.	MAXIMA.			MINIMA.			MEAN.		
	1892	1893	1894	1892	1893	1894	1892	1893	1894
January	42	38	38	-35	-32	-38	2.7	-3.0	2.6
February	43	42	38	-28	-41	-22	10.1	-1.4	6.2
March	65	39	52	-17	-27	-16	21.0	10.9	26.4
April	65	56	78	Lost	10	18	38.1	32.6	42.3
May	70	84	94	27	26	27	46.0	51.8	55.2
June	83	101	96	37	41	33	62.8	70.1	69.0
July	87	93	99	40	44	44	68.9	70 4	69.8
August	88	94	94	39	34	38	67.4	65.4	67.1
September	84	90	98	31	15	20	59.7	56.7	58.2
October	83	72	71	12	11	23	47.0	36.3	.....
November	52	36	49	-12	8.9	-16	20.0	20.8	22.1
December	38	12	46	-27	-10.9	-24	5.4	1.7	.....

RAINFALL.

MONTH.	INCHES.		
	1892	1893	1894
January	.04	.22	.09
February	.27	.11	.09
March	1.07	.71	1.29
April	2.42	2.63	3.35
May	3.88	0.77	2.62
June	1.93	3.62	6.23
July	5.02	2.20	.80
August	4.03	2.72	1.17
September	1.39	.87	.56
October	.36	.90	2.11
November	.50	1.00	.29
December	.12	.41	.12
Total	21.03	16.16	18.72

The demands made upon the chemical department for analysis of various products of interest and value to the farmers of our State is constantly growing, and is already larger than we are able to meet, and unless more room is provided and assistance furnished to carry on the work, it will be necessary to turn away much of the work that properly should be done at this institution. Our State is young, and the farmers should have every assistance possible given them in starting in new and untried lines of agriculture, and in developing the natural resources of the State. The department of chemistry can render valuable aid if only proper facilities and assistance can be had, and therefore I recommend that an assistant be furnished during the coming year.

VETERINARY DEPARTMENT.

The past year has been devoted chiefly to the further investigation of the effects of the feeding of millet to horses. This work is still in progress, and is being developed as rapidly as possible.

During the past year one bulletin on tuberculosis has been sent out, for the most part being a compilation of other bulletins and works on that subject. The department has experimented with the use of tuberculin for the diagnosis of tuberculosis, and has collected evidence as far as possible to show the distribution of this disease throughout the State. The evidence thus far obtained tends to show that all centers of infection have been imported from other states, and that where the disease has been so imported it has spread to the remaining members of the herd. If proper provisions were observed in buying stock, the disease could be eradicated from the State in a short time, and it would

be well for all purchasers of stock to bear in mind that this disease is contagious and is transmitted not only from one animal to another, but also from the cows to the human subject through the medium of the milk.

HORTICULTURAL DEPARTMENT.

The subject of vegetable culture from the standpoint of the market and general gardener has been taken up systematically along the various lines to determine the methods suited to the peculiarities of our soil, climate and market, and incidentally to test the relative value of varieties.

The following conclusions have been reached concerning the following garden crops for this locality:

Beans.—All kinds but the Jackson Wonder have been destroyed for the last two seasons by a bacterial disease called "bean blight." Measures adopted last year failed to check this. Work in this line is still in progress.

Celery.—It is difficult in this locality to harvest an early crop in season to compete with the high prices of early celery from Kalamazoo and elsewhere. Better results were obtained with celery transplanted about July 15th. This enables a crop of early cabbage to be harvested from the same ground before this period. Celery harvested in the last half of October from plants set July 15th more than holds its own in our local markets. The Golden Heart is grown in preference to any other variety. The soil must be in good condition to produce a heavy crop in the time mentioned.

Cabbage.—Good market for the very earliest sorts. Later sorts generally grown with little profit owing to attacks of the larvæ of the cabbage butterfly, the tendency of late cabbage to crack open, and the lower price received for the later sorts. Remedies for the insect mentioned (often called cabbage worm) are, water heated to 180 degrees Fahrenheit, and sprayed on the cabbages, or pyrethrum and flour, in the proportion of one to four, dusted upon the leaves.

Cauliflower.—The early kinds have been found more profitable than the late. Snowball and Dwarf Erfurt (extra early) are good growers.

Tomatoes.—No advantage has been obtained thus far from any special form of pruning or training. The very early and irregular sorts are not profitable in a market way. Dwarf Champion combines earliness, size, quality and productiveness, and freedom from rot, to a greater degree than any other kind.

Onions.—Not generally very profitable in this locality as ordinarily grown, owing to drought and short season. For profitable culture select a large sort (Prizetaker is the best), sow thickly in flats under glass in hot bed or forcing house, about April 1st, keep

plants sheared to height of four inches, transplant into open ground early in May, with plants four inches apart, in rows fourteen inches apart. The cost of growing is about the same as by the ordinary method, yield from two to five times as great. The chief advantage is in securing a growth before the summer drought sets in, thus insuring early ripening.

Fruit Culture.—Apples, plums, grapes and berries have been tried with the following results: Several sorts of apples have been found hardy so far as tried, but none of them have withstood the repeated attacks of pear blight.

Native plums transplanted three years ago began to bear heavily the first year after transplanting, the fruit reaching a diameter of 1¼ to 1½ inches. None of the cultivated kinds have entirely escaped winter killing.

Raspberries should be planted only on loose and well drained soils. Not profitable in clay and shallow soils. Souhegan, Ohio, Marlboro, Gregg and Turner all pass the winter without injury where protected with earth, and yield well in loose soil. No kind of protection has succeeded in saving any kind of grape for more than two seasons. In warmer and lighter soils, where the growth would be more apt to mature, they might stand some chance of passing the winter without killing, but it is doubtful if their culture can ever be made profitable so far north.

Many of the leading forest and ornamental trees are growing in the station arboretum to determine their hardiness and general adaptability to our locality.

BOTANICAL DEPARTMENT.

The work of the department has been, essentially, investigation upon subjects in the lines of plant physiology and of mycology. The purposes of the Experiment Station work, being in mind, the investigations are naturally conducted as special studies within the broad fields mentioned. The chief work has been expended upon two lines. (1) Physiological studies of the wheat plant with two points in view: (a) The effect of variations in quality of seed upon the product; and (b) investigation of the effects of a change of soil upon the development of the wheat plant. (2) Bacteriological investigation (a) concerning drinking water, and (b) the bacteriological flora of milk and of the dairy. Each of these lines of work has developed points of much economic interest. The investigations of milk have been greatly aided because of the leave of absence granted by the Board of Control, whereby I was allowed to spend the months of July and August at the dairy and bacteriological laboratories of Wisconsin University, the courtesy of the management of that institution allowing me to make use of the facilities furnished by their magnificently working dairy, creamery and cheese factory.

Wheat Investigation.—As a continuation of the work of 1893, in which it was shown that, though injured and weakened types of seed wheat always resulted in loss in yield, the product, as to the form and type of the grain, seemed always to reach a normal type (see Bulletin No. 13, April 1894), it was thought that experiment upon the effect of soil upon the growth of wheat must be one of interest and value to wheat growers, as it is a common practice to exchange seed. This work, as in 1893, has been taken up under two methods of investigation, viz: First, careful growth and study in the field, and second, a study of the grain and of the product, in order to note variations, if any should occur. Two methods of growth in fields were undertaken: First, the selection of standard types of seed of known history, grown previously for a number of years at Fargo, on lands similar to the Station soil. This seed was sent to farmers in various portions of the State, and seeded after a standard method, thus growing the same upon the various characteristic soils of the State. Second, the procuring of standard types of seed of known history from farmers living in various portions of the State, and the growing of the same upon Station soil. The different types of seed were sown, as in 1893, in alternate pockets of a drill, thus placing samples from originally very varied types of soil under, essentially, similar conditions. These investigations have given basis for some emphatic statements regarding the feasibility of seed exchange. A summary of investigations indicates that there is, from the standpoint of the farmer, no real basis for the exchanging of seed, because of any induced variation in the type. The methods and results are now being summarized in a bulletin.

Bacteriological Investigation. — There is, perhaps, no question so often received at the Experiment Station as the one regarding the quality of various types of drinking water. Usually the question is accompanied with a poorly taken sample. Such samples are of little value either to the chemist or the botanist, because of the lack of knowledge of the manner in which they are taken, and the specially unbacteriological conditions observed in the methods of taking. This indicates that the question of bacteriological analyses is not well understood by those most concerned. Such analyses, though accurate and very definite in the results which they ultimately attain, presuppose an amount of work so exacting in its methods that it is impossible for this department, with its present lack of assistance, to undertake to give analyses of waters sent in by individual owners of wells. The work itself is a most important one from the standpoint of State interest, and as time and facilities allow, it will be kept under consideration. It is an interesting but rather unfortunate fact that typhoid fever is quite a

common disease throughout isolated farming regions of our State, often in localities where water is not obtained from other than individual wells. Because of this consideration it is the intention of the department gradually to investigate the relationship of that disease, if any, to the various well waters of the State, and at present a number of wells are under consideration with regard to the actual bacteriological flora which they possess during the winter and summer. It is hoped to investigate the relationship of typhoid germs to various types of water as to growth, multiplication and pathogenic virulence. That the department can be of great aid to the sanitation of the State is noticeable in the success and speed in which the real cause of the spread and prevalence of the epidemic at Grand Forks was demonstrated; and further in the demonstration of the location from which a local infection was occasioned at Power, N. D. The source, in this case, being quite certainly the water of a small creek, receiving the drainage water of a large swamp, and being infected by sewerage from a private vault where the first case occurred. In this connection, it is well to caution our people against allowing milch cows to wade about in sewerage infected streams and ponds. It seems very probable that the disease may be transmitted by the dropping of dirt from the udders and bellies of the animals to the milk, in milking.

The studies of milk and dairy conditions is being prosecuted with reference to the recommendation of proper methods of handling milk and the various dairy products, care of animals and methods of stabling. In other words, an investigation of the bacteria which are ordinarily found in milk, because of bad methods, and also the sources of contamination. This question of dirt in milk and methods of proper handling of the milk previous to its use for the manufacture of such products as butter and cheese, or its appearance on the market as a drink, is of the greatest importance. Not only the principles of making of proper products, as butter and cheese, but also the reasons for the proceedure necessary to the avoidance of abnormal products, such as ill smelling, bad tasting, poor keeping types of butter, or floating curds in cheese making, are directly based upon the proper consideration of bacteriological facts.

PUBLICATIONS. —Since our last report one regular bulletin has been issued from the Botanical Department, Bulletin No. 13, illustrating and demonstrating methods of rational selection of wheat for seed, containing also an article upon typhoid fever.

In the article concerning the rational selection of wheat was pointed out the fact that the wheat product of the State is not of as high a grade with regard to the size and milling qualities of the grains as it should be, due, chiefly, first to carelessness in the care of grain at and after harvest time, and, second, irrational selection of weakened, injured and disease bearing types. A summary of

the points discussed in that bulletin is: (1) General principles of wheat selection properly operating on the farm; (2) that pure varieties should be selected; (3) that selection should be made with reference to the elimination of weed seeds and disease; and (4) that it is poor economy to sow a type of seed that is of doubtful character, or in the least inferior, because of any type of injury that may have occurred to it, as frosting, bin burning, winter bleaching, or immaturity. Results were always markedly in favor of that grade of seed which contained the largest, heaviest grains. It is further pointed out that this method of general selection is in conformity with the aims of the rules governing special selection for the betterment of type or variety.

Miscellaneous Studies.—A number of minor studies have been under consideration, among which may be mentioned: (1) continued work upon the prevention of potato scab; (2) consideration as to the variation of the progeny of plants (a) because of the type of seed used, and (b) because of continuous system of cutting; (3) the collection of weed seeds, and studies regarding the distribution of the same.

Concerning the question of weed seed dissemination, it would be a matter of economic consideration to understand just how much influence our winter winds and the drifting of snow and dirt have to do in carrying the different types of seed. Experiments to obtain some facts upon these points are now under way. A proper knowledge would give us a basis for a statement with regard to the value of attempting to fence against the encroachment of several of our worst weeds, which is quite loudly advocated by many, even to the enactment of laws and appropriations by the State for the purpose of fencing. The idea that fences could be of any lasting value in our struggles with such a weed as the Russian thistle does not seem well based, but further facts are needed to substantiate this assertion.

It may be well to note that the large and quite complete collection of the native flora of the State is gradually being properly mounted, labeled and placed in position in the herbarium. From the standpoint of economic value it has, for the purposes of comparison and illustration, marked merits, and the collection of grasses illustrates almost a complete survey of the State, as to all its types of soil. There is in this collection also quite a complete representation of the various diseased types of our economic and native plants.

The Results Attained by Farmers in the Use of Preventives for Plant Disease. The interest taken by farmers of the State in various studies of plant diseases, and the methods of prevention is of a very active and commendable type. I may here refer to work done with reference to the prevention of wheat smuts and potato scab. The hot water

treatment with regard to smut does not go into general use because of a belief on the part of the farmers regarding the difficulty of maintaining the temperature of the water, and the final drying of the grain. This is, in chief part, a matter of the lack, on the part of the ones interested, to provide themselves with the necessary vessels for heating water, and sufficiently large tanks into which to dip. When once they have undertaken the work, they will not fail to take the necessary precautions to be certain of clean seed for the year following. By properly shoveling over on the barn floor, a very large bulk of grain can be dried for seeding upon the following day.

Many have used the copper sulphate treatment successully. For example, Mr. R. S. Lewis, of Fargo, in 1894 treated 1,600 bushels with marked success. If such enterprising methods as this are prosecuted, smut will soon be a slight cause of worry to the farmers, and the reputation of the wheat product of the State will be very greatly enhanced. While this last named treatment is to be recommended against no treatment, it is not as good as the hot water one. The great difficulty with regard to both of the methods is the injury of the seed by swelling, and difficulty with regard to drying. This department is trying to discover a method of treatment which will eliminate, as nearly as possible, the difficulties complained of. More than one hundred different experiments, made last year, indicate that we have good reason for hope of success the coming season.

In the case of the prevention of potato scab, none who have tried the method recommended in our Bulletins No. 4 and 9 have reported other than success. In refutation of discouraging reports sent out by several eastern station workers I append here statements of some of the farmers who have used the corrosive sublimate treatment during the past three years.

George Bilsborrow, Supt. of Allen Farm, Minn.: "There is no scab on the field crop, although the seed used was somewhat scabby. I think that it paid well, and I am satisfied that the solution destroyed all the scab on the seed. I shall soak all my seed next spring."—*See Rural New Yorker, October 28th, 1893.*

V. D. S., Virra, Pa.: "The corrosive sublimate treatment for potato scab has come to stay. One barrel of solution will treat about twenty bushels of potatoes, and we believe the result will be sure."—*See Rural New Yorker, Nov. 11th, 1893.*

E. H. Currier, River Falls, Wis.: Mr. Currier treated 560 bushels of seed potatoes; he also planted 140 bushels of untreated tubers. He writes: "It took one man about thirty minutes to shovel out thirty bushels with a screen potato shovel. The result is so far the cleanest lot of potatoes I ever dug. I consider that I increased the value of my crop at least $8 per acre."

W. D. Kirkland, Sheboygan Falls, Wis.: "My neighbor, Mr.

H. Gardner, and myself each made thorough tests of the corrosive sublimate treatment. We pronounce it a thorough success."

J. J. Nierling, Jamestown, N. D.: "Last spring I treated sufficient seed for planting eight acres, the seed being very scabby. Treated same according to directions given in your bulletin. The result is that I have an excellent crop of nice, smooth potatoes. Do not believe out of this entire treated crop half a bushel of potatoes can be found that have any indication of scab, and the tubers are of a much larger size than those from untreated seeds. The experiment has certainly been very valuable to me, being able to realize from 10 to 15 cents per bushel more for the treated than the untreated, and the yield being much better. The cost of treatment was not to exceed $1.50 for the eight acres of seed besides the labor, which was practically nothing worth mentioning."

These statements are but characteristic of many similar reports and letters at hand from farmers representing more than one-half of the states. Furthermore our own field crop of several acres again attests the perfect effects of the treatment. It is hoped that no one will fail to make use of this effective and inexpensive preventive because of the statements of persons who have failed to conform to proper conditions and methods.

AGRICULTURAL DEPARTMENT.

In this department crop experiments have been continued along the lines already begun, and in some new directions also. Special study and tests of forage plants have been undertaken. A number of varieties of corn have been grown, and tests made of of their value as grain and fodder producers. A hundred tons of green corn was put into the silo, and a comparison of it with fodder as a food for cows is being made. Variety tests of barley, wheat, oats, millet, flax, potatoes and peas were made. Different methods of cultivation and seeding have also been tested with wheat and oats; also different widths of drills and times of seeding. An experiment in harrowing wheat after it is growing was also conducted.

A special study of forage crops has been begun. Oats and peas mixed in different proportions and with different methods of seeding have been tested. A number of grass mixtures are being tested, and different methods of seeding have also been tried.

Breeding and selection of wheat and timothy has also been continued, and a number of new varieties of grasses are being grown in small plots for trial. Kaffir corn, Jerusalem desert corn, and Dhoura, or African millet, have also been grown to test their value as forage plants for this State.

Dwarf Essex rape has been tested by sowing in drills and

broadcast. A number of Japanese varieties of rape have also been grown.

The twenty-nine rotation plots on the Experiment Station grounds have been continued, and six more added, as follows:

Plot No. 30—Flax two years, wheat two, flax two, etc.; No. 31—Flax one year, wheat one year, flax one year, etc.; No. 32—Timothy two years, wheat one, flax one, wheat two, timothy two, etc.; No. 33 - Wheat, fallow, wheat, flax, wheat, fallow, etc.; No. 34 - Wheat two, corn one, flax one, etc.; No. 35 —Wheat two, flax one, corn one, wheat two, flax one, corn one, wheat two, flax one, corn one, etc.

Grain rations for horses on hard and medium work, and cheap winter rations for horses at light work, and idle, have been tested, and some very interesting results have already been attained.

A test of grain rations for fattening sheep, and of the length of time which they can be fed a full grain with paying results have been made. Most of the above data will be published in bulletins later.

Tests of rations for cows and the performance of the Station herd consisting of common cows and low grades has been made, and the results published in Bulletin No. 16 of the Station. It brings out clearly the following: 1. Dairying with the cows which are on the farms of North Dakota can be made profitable. 2. That excellent cows for butter production can be found among the native and low grade cows of the State. 3. That some of both natives and low grades can not be kept at a profit, giving too little butter to pay for the food which they consume. 4. That it pays to feed well on account of so large a proportion of the food eaten being required for maintenance. 5. Grain fed to cows in addition to good pasture did not increase the milk yield sufficiently to be profitable. Dehorning milch cows caused very little falling off in milk and butter.

Rules for handling milk, using and caring for cream separators, ripening cream, churning, salting, working, packing and marketing butter, all based on the study and tests made by the author in the Station dairy and elsewhere, are given in detail in Bulletin No. 16.

PUBLICATIONS.

During the year the following bulletins have been issued, and the conclusions arrived at from the experiments made are briefly stated:

BULLETIN NO. 12.

Transplanting Onions.—Time of maturity, size, form, quality, productiveness and other general characters may all be modified and governed to a greater or less extent by transplanting. Difference in yields show a great advantage from transplanting. Trans-

planted onions produce large, regular, mature bulbs, greatly excelling others in keeping and market qualities. Cost of transplanting and care following will not exceed the cost of hand weeding and thinning necessary under ordinary methods. Saving of seed when transplanting is an item that reduced expense. Results favor transplanting in this locality, if large yields and superior bulbs are wanted.

BULLETIN NO. 13.

Rational Selection of Wheat for Seed; Typhoid Fever.—Pure varieties and fully matured seed should be selected. Immature wheats, whatever the cause, are liable to immature germs and the seed value is weakened. No advantage in mixed seed, for as the wheat plant is self-fertilizing no "cross" can be obtained, as some suppose. Mixed seed is liable to result in loss of crop, for different varieties may not ripen at same time. Weed and disease-contaminated seed to be discarded under all circumstances. Wheat that has been wet and subjected to freezing and thawing is not reliable seed. Wheat that has been heated in bin because of moisture is liable to great injury for seed. The largest, heaviest seeds give the best results.

Typhoid Fever—Preventive Precautions—Cleanliness About the Home Premises.—Avoid use of water subject to sewerage contamination, or containing much organic matter, such as common slough or surface water. Guard all wells against running drainage water from barn yards or vaults. When disease prevails, avoid use of any vessels used by the sick, and thoroughly cook substances taken into the stomach, or which may come in contact with the mouth.

BULLETIN NO. 14.

Tuberculosis.—Tuberculosis is contagious. It is transmissible from animal to man through the medium of milk and flesh. To insure safety in a dairy herd, never purchase animals for dairy purposes unless they have been shown by the tuberculin test to be absolutely free from the disease, and for any purpose never purchase animals, although free from disease, that come from a herd that has shown tuberculosis.

BULLETIN NO. 15.

Chemical Composition of Foods.—The native prairie hay of North Dakota is richer in fat producing elements than is Timothy, Orchard Grass, Kentucky Blue Grass, Millet or any of the clovers, but has, to a greater or less degree, a smaller quantity of albuminoids than the others. Oat straw has a greater amount of fat, but less of albuminoids than wheat straw. Wheat screenings is a valuable food product, that in the central market sells for $8 to $10

per ton. The average dockage at elevators in this State is one and one-half pounds to the bushel, and by failure to clean grain before marketing, our farmers are making an annual gift of from $230,000 to $250,000 to the elevator companies.

RUSSIAN CACTUS.

This troublesome weed has taken exclusive possession of some fields in certain localities of our State, and is now recognized as a standing menace to the farming interests of the State. We recognize its power for evil, but do not consider it a difficult weed to keep under control, if taken in hand when first appearing. In answer to the many inquiries regarding the weed, the Station issued a special press bulletin, giving description of the plant, its character and habit, and suggestions as to its control and destruction. The edition was quickly exhausted, but inquiries for information still continue, and I reproduce the essential points of the bulletin.

Under heading of "Points to Keep in Mind:"

First—This weed grows only from seed. Only weeds which have been allowed to reach large size ever tumble. These are, in most parts, found only in waste places, or improperly cultivated spots, such as margins of wheat fields, old fire breaks, gopher knolls, etc.

Second—At any time when weeds are mature enough to break loose of their own accord they can be collected and burned.

Third—The weed perishes immediately by being uprooted or cut off at the base, and its seeds are short-lived. When growing in small form because of its density upon the ground, it may be turned under by the plow in early August, and thus in most parts be destroyed.

Fourth—It does not grow upon the native prairie, except where sod has been broken by roads, animals, or the plow. During the month of August comparatively a small force of workmen would suffice to destroy all weeds upon road margins and the wild lands of the worst infested township in the State.

Fifth—The weed matures its seed but slowly, so that if destroyed during the early portion of the season, frost will very effectually destroy the later plants.

Sixth—Aside from its tumbling capacities this weed possesses no quality which would make it hard to exterminate under a careful system of farming and road management.

Seventh—This weed is spreading more rapidly, perhaps, than any heretofore known, and under the present loose attention which it is receiving, will soon cause an enormous amount of damage throughout the State. When once it has taken possession of a large area of land, only heroic measures will keep it in check.

There are, however, no good reasons why it should be allowed continually to encroach upon new land.

Eighth—Sow no small grain that is not thoroughly clean from weed seeds.

Ninth—Fencing is not an effectual barrier against the rolling weed.

Tenth—Do not break up any more of the native soil than you can tend and keep clean.

Eleventh—Seed early and thickly.

Twelfth—Do not allow scattering weeds to reach tumbling size. Where it is abundant, mow, rake and stack as you would hay; then burn.

Thirteenth—The weed should be plowed under when immature.

Fourteenth—Never try to run a barren fallow where this plant is abundant.

Fifteenth—In place of fencing, the following plan for a barrier is suggested: Sow each spring a strip of sunflowers of one or two drill widths around each field. Cultivate and induce these to grow as dense and strong as possible. Leave the stalks standing during the following autumn and winter, clearing the ground by fire in the spring.

Sixteenth—We believe that each farmer can readily keep his own farm clear of this weed, provided it is kept off the waste lands and roadside.

FARMERS' INSTITUTES.

The act creating experiment stations recognizes two types of valuable work to be accomplished by the station, viz: Investigation and education. During the past year considerable time has been demanded of the Station workers by farmers' institutes, and this is one of the most effective ways in which farmers can obtain much of the practical benefits of Station work. Lectures have been prepared and delivered at various institutes on different subjects, such as dairying, gardening and small fruits, diversified agriculture, smut in grain, nitrogen and summer fallowing, diseases of dairy animals and their treatment, wheat vs. live stock, bacteria and their relation to the dairy, grasses and weeds, domestic economy, the dairy cow, manual training, how plants grow, nature and distribution of weeds, selection of seed grain, etc. These meetings have been largely attended and are of great value and interest to all, always ending with strongly expressed desire for continuation.

CONCLUSION.

A brief summary of the result of the work is all that is given in the Annual Report. The detailed statements of methods and

the result of investigations in special lines are given in the regularly issued bulletins, that are, to the extent of the edition, mailed to all citizens of the State that request them.

The constantly increasing demand from farmers of the State (by letter and otherwise) upon the Station, for information as to many phases of their work, shows that they are recognizing it as an institution conducted in the interest of the farmers, that they recognize the possibility of its great assistance to them in their work, and desirous that this recognition become much more general, we invite all citizens of the State to put themselves in touch with the Station and its working staff, by correspondence or visitation.

Very respectfully submitted,

J. B. POWER,

Director.

January 21st, 1895.

THE AGRICULTURAL EXPERIMENT STATION OF NORTH DAKOTA IN ACCOUNT WITH THE UNITED STATES FOR THE YEAR ENDING JUNE 30TH, 1894.

Receipts.

Date.	From whom received.	Amount.
July, 1893	United States Treasurer	$3,750 00
December, 1893	" " "	3,750 00
January, 1894	" " "	3,750 00
June, 1894	" " "	3,580 62
" "	Room rent	120 00
" "	Board	1,105 60
" "	Sale of sheep	55 56
" "	Sale of wheat	638 19
	Total	$16,749 97

Expenditures.

Date.	For what purpose.	Amount.
June 30, 1894	Apparatus	$40 20
" "	Books	68 63
" "	Freight and express	444 54
" "	Fuel	1,344 83
" "	Labor	5,057 07
" "	Postage	132 40
" "	Printing	732 75
" "	Repairs	118 15
" "	Salaries	5,077 65
" "	Stationery	68 90
" "	Supplies	2,800 28
" "	Telegraph and telephone	73 80
" "	Traveling expenses	148 25
" "	General expense	69 85
" "	Building	572 67
	Total	$16,749 97

The above is a correct statement of receipts and expenditures of government appropriations for the North Dakota Agricultural Experiment Station for the year ending June 30th, 1894, as taken from my books.

WM. G. HAYDEN,
Accounting Officer.